

Carbonate Fuel Cell Monolith Design For High Power Density And Low Cost

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INTRODUCTION

The SBIR research is aimed at the development of an innovative monolith carbonate fuel cell bipolar plate design to provide higher power density operation and cost reduction. The carbonate fuel cell is widely recognized as a clean, efficient and economically competitive source of electric power for the future. The power plant is entering the commercial prototype demonstration phase. Reduction of fuel cell cost is desired to further stimulate market interest in this unique power generating technology.

OBJECTIVES

This SBIR project proposes reduced fuel cell power plant costs by: enhanced power density operation, consolidation and elimination of cell parts, reduction of cell material usage, and reduction of cell thickness (enhanced volumetric power density).

RESULTS

The specific goals were achieved by the design of a bipolar plate where the separate corrugated current collectors used in the baseline design are eliminated (Figure 1). The cost reduction of this simplified design was also derived through higher power density operation, and reduced material usage (Figure 2). The higher volumetric power density operation was accomplished by lower cell resistance, increased active component surface area and reduced cell height (Figure 3).

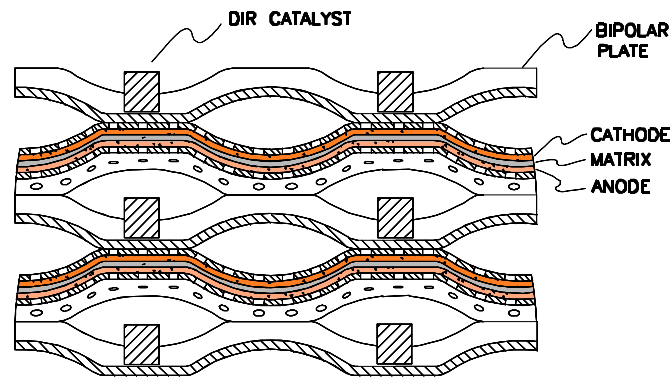


Figure 1. MONOLITH FUEL CELL "CROSS-SECTIONAL" VIEW:
The Baseline Current Collectors Have Been Replaced With an Integrally
Corrugated Bipolar Plate/Current Collector Structure

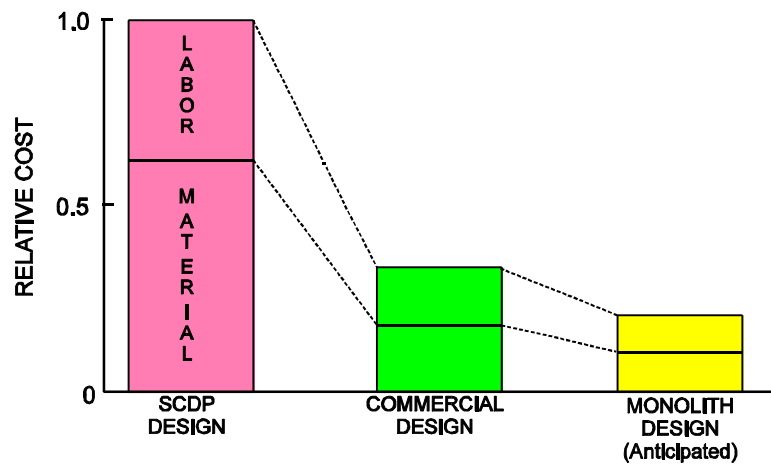


Figure 2. CELL COMPONENT COST REDUCTION:
Four Fold Cost Reduction Projected for the Monolith Fuel Cell

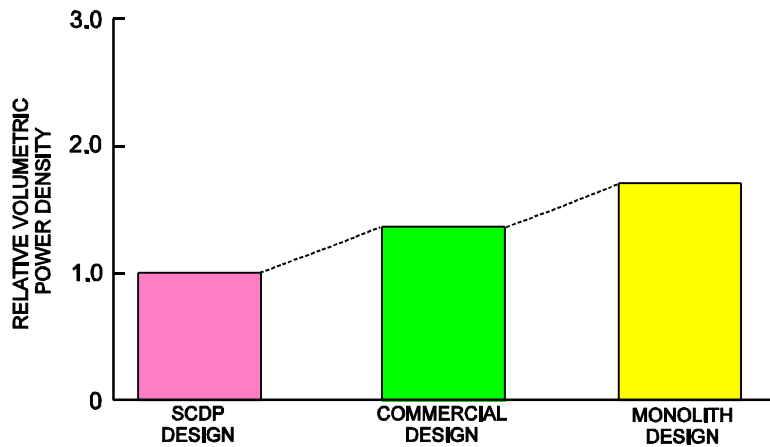


Figure 3. CELL COMPONENT VOLUMETRIC POWER DENSITY IMPROVEMENTS:
50% Increase in Volumetric Power Density Achieved Through
Performance Improvements and Thinner Components

The overall objectives of this program were verified at the lab scale level. Several single cells were operated with monolith design active components and cell hardware. Significant performance improvement (20-30 mV) was shown with the monolith hardware as compared to baseline cell designs (Figure 4). A monolith design single cell has been operated for over 2000 hours with little performance decay. A multicell laboratory size stack (250 cm²) was recently operated. This small stack provided proof-of-concept verification of manufacture and operation of monolith cells. Further design optimization and verification of this unique monolith fuel cell design for high power density and low cost are planned for next year.

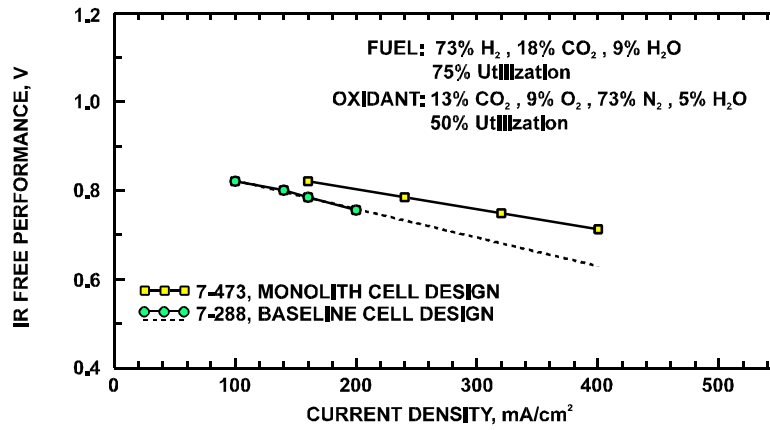


Figure 4. PERFORMANCE COMPARISON:
Increased Cell Performance Shown With Monolith Design
Active Components and Active Component Hardware

ACKNOWLEDGEMENT

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